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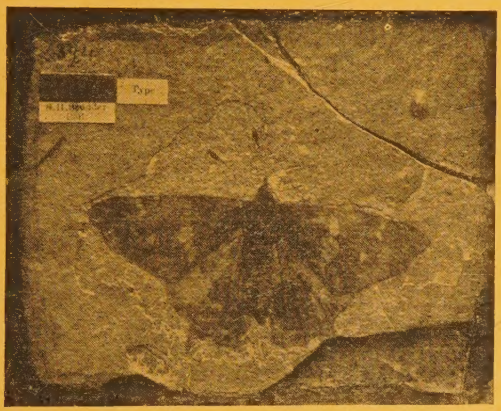

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CONTENTS.

The Nearctic Psammocharids of the Genus Aporinellus Banks. *J. Bequaert* . 115

A Singular Neotropical Ant (*Pseudomyrma filiformis* Fabricius. *W. M. Wheeler* 124

Notes on *Eustrophus bicolor* Fabr., Bred from Fungi (Coleoptera) *H. B. Weiss* 130

Notes on Forest Insects. II. Notes on Several Species of Pityophthorus Breeding in the Limbs and Twigs of White Pine. *W. M. Blackman* . . 133

The Occurrence of *Anopheles punctipennis* in Northern New England. *C. T. Brues* 142

Exchange Column 144

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PSYCHE

VOL. XXVI OCTOBER, 1919 No. 5

THE NEARCTIC PSAMMOCHARIDS OF THE GENUS APORINELLUS BANKS.

By J. Bequaert,
American Museum of Natural History, New York City.

On one of the collecting trips made this summer with Prof. William M. Wheeler, in the vicinity of Boston, I collected a little Psammocharid which has proved to be an undescribed species of *Aporinellus*. In comparing this specimen with Mr. Nathan Banks' extensive collection of Psammocharids I have found another undescribed member of the same genus. Descriptions of both forms are given herewith, together with a brief review of the group. I am much indebted to Mr. Nathan Banks, of the Museum of Comparative Zoölogy, Cambridge, Mass., for the loan of rich material containing many types and for valuable bibliographic help.

The genus *Aporinellus* Banks[1] includes small Psammocharinæ with the propodeum smooth, emarginate behind when seen from above, its posterior angles conical, sharp or obtusely rounded at the apex. Thorax convex above, the pronotum not flattened and shorter than or about the length of the mesonotum. The head is feebly flattened antero-posteriorly; the anterior margin of the clypeus straightly truncate. Tarsal comb of the fore legs well developed; the tibiæ and tarsi otherwise feebly spinose. Claws with a tooth about the middle of their length. There are no long erect hairs on the cheeks, gula, coxæ and propodeum. Fore wings with two closed cubital cells; the transverse median reaches the media before the origin of the basal vein; in the hind wings the transverse median ends before or close to the cubitus.

Aporinellus is represented by several species throughout the United States and also exists in Mexico; whether the genus occurs in Canada is not known. It is, however, probable that its range

[1] Journ. New York Ent. Soc. 19, 1911, p. 223.

includes several other zoölogical regions. Indeed, the genus *Aporinellus* as defined above, agrees with Kohl's "Group 14 of *Pompilus* Fabricius"[1] and this identity was recognized by Sustera.[2] *Psammochares sexmaculatus* (Spinola) of which I have seen a ♀ from Corsica in Mr. Banks' collection, has the same structure of the propodeum as *Aporinellus*, but differs in the presence of a third, petiolate cubital cell in the fore wings; similar forms are apparently not known from the Nearctic Region.

Several of the species of *Aporinellus* have originally been described as *Aporus*. As shown by Banks the true *Aporus* Spinola is structurally very different and has thus far not been found in North America. I have examined two palearctic species, *Aporus unicolor* Spinola (the genotype) and *A. dubius* Van der Linden; in these the propodeum is not or scarcely emarginate behind and its lateral angles are not produced; the fore wings have two cubital cells and the transverse median ends on the media far beyond the basal. As suggested by Kohl, *Aporus* Spinola is more closely related to typical *Psammochares* Latreille (*Pompilus* Fabricius) with three cubital cells, from which it evidently has been derived. According to Banks, the true *Aporus* is also structurally close to the North American *Psammochares marginatus* (Say). On the other hand, Ashmead's genus *Aporus*[3] evidently possesses all the characteristics of *Aporinellus* Banks which are, however, not present in *Aporus unicolor* Spinola.

The wasps of the genus *Aporinellus* are not frequently met with; they are usually found while running about in search of their prey and seldom visit flowers. The nesting habits are only known of *A. fasciatus*, which was studied in Wisconsin by G. W. and E. G. Peckham.[4] The ethology of this wasp agrees with that exhibited by most Psammocharids. The prey consists of spiders belonging to various genera (*Phidippus*, *Attus*, *Mœvia*) of the family Attidæ. The female first captures her spider which is slightly paralyzed, dragged to the nesting site and temporarily deposited on a leaf. She then makes a careful study of the locality to discover a suitable spot for her burrow. Often several burrows are started and abandoned before the final choice is made. "The one habit that this

[1] Verh. zool.-bot. Ges. Wien 34, 1884, p. 54.
[2] *Ibid.* 62, 1912, p. 212.
[3] Canadian Entom. 34, 1902, p. 87.
[4] Wisconsin Geol. Nat. Hist. Survey Bull. No. 2, 1898, pp. 55–57.

species can claim as peculiar to itself is that of filling up the partly made nests that it is about to abandon. We have never seen the sense of order carried to so high a point in any other wasp" (G. and E. Peckham). After digging is completed, the spider is dragged inside and the egg fastened to the side of the abdomen of the prey; the entrance is then carefully filled up. When finished the burrow is a small gallery running down obliquely for an inch and a half in the ground. The spider is only slightly affected by the poison of the sting, this wasp depending probably more upon packing her victim in tightly to keep it quiet.

The following key will aid in separating the females of the species known from the eastern and central states, all of which I have examined in nature. In addition there are several Californian species tabulated by Mr. Nathan Banks in a forthcoming paper.

1. Body almost entirely reddish; head except the clypeus, and antennæ beyond the second joint, black. Wings blackish at tip, the second cubital cell scarcely longer than broad. Face below, posterior margin of pronotum and apical fasciæ of the abdominal tergites feebly sericeous. Tarsal comb long. Length: 5 to 6 mm. (♂ unknown) . . . . . **rufus** Banks.

   Not reddish throughout . . . . . 2.

2. Legs, at least the hind pair, mostly reddish . . . . . 3.

   Body and legs entirely black, with sericeous or silvery pubescence . . . . . 5.

3. Body silvery, with distinct sericeous apical fasciæ on the abdominal tergites. Color black; the mandibles in their middle, the hind tibiæ and femora entirely and the basal joints of the hind tarsi partly, reddish. Head and tarsal comb as in *fasciatus*, from which this species differs in the second cubital cell being only $1\frac{1}{2}$ as long as broad. Length: 5 to 7 mm. (♂ unknown) . . . . . **ferrugineipes** (Viereck).

   Body smooth, very feebly pruinose, not sericeous, the abdomen without silvery fasciæ. Second cubital cell $\frac{1}{3}$ to $\frac{1}{2}$ as long as broad . . . . . 4.

4. First three abdominal segments and all the legs for the larger part reddish. Ocellar triangle little flattened, the lateral ocelli only feebly nearer to the eyes than to each other. Tar-

sal comb short, its bristles less than half the length of the fore basitarsus. Length: 7 mm. (♂ unknown). **wheeleri** sp. nov.

Black; apex of the first two abdominal tergites with a scarcely visible rufous tinge; hind tibiæ and femora entirely, and hind tarsi partly reddish. Ocellar triangle distinctly flattened, the lateral ocelli much farther from each other than from the eyes. Tarsal comb long, its bristles over half the length of the fore basitarsus. Length: 6.5 mm. (♂ unknown)

banksi sp. nov.

5. Vertex as broad or slightly broader than the face below. Lateral ocelli nearer to the eyes than to each other. Second cubital cell over twice as long as broad. Abdomen with distinct silvery apical fasciæ. Length: 7–8 mm. (♂ unknown) ..... **laticeps** Banks.

Vertex narrower than face below; lateral ocelli hardly nearer to the eyes than to each other. Second cubital cell about twice as long as broad ..... 6.

6. Body, except the apical two abdominal segments, uniformly sericeous. Posterior emargination of the propodeum feeble, the lateral angles small. Length: 5.5 to 6 mm.

completus Banks.

Sericeous pubescence interrupted by black cross bands, especially on the second to fourth abdominal tergites which have distinct silvery apical fasciæ. Posterior angles of the propodeum very pronounced, large. Length: ♀, 6 to 8 mm.; ♂, 4.5 to 6.5 mm. ..... **fasciatus** (Smith).

Aporinellus wheeleri sp. nov.

Female. Length 7 mm.

Head distinctly broader than the thorax. Inner margins of the eyes subparallel below, feebly sinuate about the middle, then slightly converging towards the vertex which is much narrower than the face at the clypeus. Ocellar triangle very little flattened, almost equilateral; the lateral ocelli hardly nearer to the eyes than to each other. Clypeus straightly truncate at the anterior margin. Antennæ moderately slender; the third and fourth joints about of the same length and about as long as the scape. Pronotum convex, much shorter than the mesonotum when seen from above, its posterior margin broadly and evenly arcuate.

Propodeum with pronounced apical emargination and acute lateral angles. Legs slender as compared with *A. fasciatus*, the femora and tibiæ hardly swollen. Comb of the fore tarsi feeble, composed of 5 or 6 short bristles, the longest of which are less than half the length of the fore basitarsus and about the length of the second tarsal joint. Fore wings with the second cubital cell comparatively short, slightly over $1\frac{1}{3}$ as long as broad. Transverse median of the hind wings ending much before the base of the cubitus.

Head mostly and thorax entirely black; anterior margin of clypeus, mandibles except their apical teeth, and first antennal joint below, more or less reddish. Abdomen with the three first segments bright ferruginous red; the apical margin of the fourth tergite faintly reddish; the remainder black. Legs red; the coxæ, trochanters, extreme tips of femora and tibiæ, tibial spurs and larger part of the tarsi, black; the basitarsus and under side of trochanters on middle and hind legs suffused with red, and a red spot on the under side of the hind coxæ. Tarsal comb and erect bristles of tibiæ and tarsi black. Wings subhyaline; fore wings with a spurious cloud on the basal vein, their apical quarter infuscate.

Tegument impunctate, very shining. Body entirely without sericeous pile, clothed in a feeble grey pruinosity, which is a little more pronounced on the propodeum. No trace of abdominal silvery fasciæ. A few erect hairs on the clypeus, mandibles, and two apical segments of the abdomen.

Described from one female taken at Stony Brook Reservation, near Boston, Mass., July 12, 1919; it was sunning itself on a stony woodroad, after the usual Psammocharid manner.

This species is very striking in its coloration and its shining integument; its closest relative is undoubtedly the species described below as *A. banksi*.

Aporinellus banksi sp. nov.

Female. Length 6.5 mm.

Head comparatively broader than in *A. fasciatus*, much broader than the thorax. Inner margins of the eyes subparallel near the clypeus, curved outwardly about the middle of the face, then feebly converging towards the vertex which is distinctly narrower

than the face below. Ocellar triangle distinctly flattened; the lateral ocelli much nearer to the eyes than to each other and about as far from the anterior ocellus as from the eyes. Clypeus straightly truncate at the apex. Antennæ slender, the basal joint (scape) about the length of the fourth, which is a little shorter than the third. Pronotum a little shorter than the mesonotum, strongly convex. Propodeum with pronounced apical emargination; its lateral angles sharp, spinose (in *A. fasciatus* these angles are obtusely rounded at the tip). Legs slender as compared with *A. fasciatus*, the hind femora and tibiæ feebly swollen. Comb of the fore tarsi long, its longest bristles about half the length of the fore basitarsus. Fore wings with the second cubital cell much shorter than in *A. fasciatus*, slightly over $1\frac{1}{3}$ as long as broad and not quite $\frac{2}{3}$ the length of the first cubital on the cubital vein. Hind wings with the transverse median ending much before the base of the cubitus; in *A. fasciatus* both veins are nearly interstitial.

Black. Mandibles except at base and apex, narrow anterior margin of clypeus, hind femora and hind tibiæ entirely, first two joints of hind tarsi partly, and spurs of the hind tibiæ, reddish brown. The apical margins of the first two abdominal tergites are very faintly suffused with brown. Wings subhyaline, with blackish veins, infuscated in their apical third.

Tegument impunctate. Body almost devoid of pubescence. A few erect hairs on the mandibles and clypeus and on the terminal segments of the abdomen. No sericeous pile; but a feeble, grey pruinosity covers the shining body and shows clearly that the specimen is in a very fresh condition.

Described from one female specimen collected by Mr. Birkman in Lee County, Texas, May, 1907.[1]

This species comes near the preceding (*wheeleri*) but is sufficiently distinct in the characters shown in the key.

List of Nearctic Species.

1. **Aporinellus apicatus** Banks, Journ. New York Ent. Soc. 19, 1911, p. 230.

   Aporus apicatus Banks, ibid. 18, 1910, p. 126, ♂.

   Type-locality: Claremont, Calif.

   In Mr. Banks' collection there are also specimens from

[1] Mus. Comp. Zoöl. Cambridge, No. 10757.

National City, Calif. (Van Duzee Coll.) and Felton, Sa. Cruz Mts., Calif. (Bradley Coll.).

2. **Aporinellus banksi** sp. nov., ♀.
   Type-locality: Lee Co., Texas.
3. **Aporinellus californicus** Rohwer, Proc. U. S. Nat. Mus. 53, 1917, p. 240, ♀.
   Type-locality: Alameda Co., Calif.
4. **Aporinellus completus** Banks, Bull. Mus. Comp. Zoöl. 61, 1917, p. 97, ♀ ♂.
   Type-locality: Lone Tree, Yakima River, Wash.
   Also recorded from Thorp, Kittitas Valley, Wash. I have seen in Mr. Banks' collection a ♀ from Boulder, Colo., September 8, 1908, on flowers of *Helianthus pumilus* (Rohwer Coll.).
5. **Aporinellus fasciatus** (F. Smith) Banks, Journ. New York Ent. Soc. 19, 1911, p. 231, ♀. Rohwer, Hymenoptera of Connecticut, 1916, p. 631.
   Aporus fasciatus F. Smith, Cat. Hym. Brit. Mus. 3, 1855, p. 175, ♂. Cresson, Trans. Amer. Ent. Soc. 1, 1867, pp. 137, ♂ and 149, ♀; *ibid.* 4, 1872, p. 27, ♂; Synopsis Hym. Amer. 1887, p. 273. Birkman, Ent. News 10, 1899, p. 244. J. B. Smith, Insects of New Jersey 1910, p. 674.
   Pompilus unionis Dalla Torre, Cat. Hym. 8, 1897, p. 330.
   Type-locality: Warm Springs, S. C.
   This is a widely distributed species being known from the following states: New York, Massachusetts, Connecticut, New Jersey, Virginia, North Carolina, South Carolina, Georgia, Texas and Colorado.
6. **Aporinellus ferrugineipes** (Viereck) Banks, Journ. New York Ent. Soc. 19, 1911, p. 230, ♀.
   Aporus ferrugineipes Viereck, Trans. Amer. Ent. Soc. 32, 1906, p. 204, ♀.
   Type-locality: Clark Co., Kans.
   In Mr. Banks' collection from Bayville, N. Y. (Banks Coll.) and Fedor, Lee Co., Texas (Birkman Coll.). I have also taken a ♀ at Wharton, Wharton Co., Texas, June 24, 1917.
7. **Aporinellus intermedius** Banks, ♀. Will be shortly described in the Bull. Mus. Comp. Zoöl.
   Type-locality: Owens River, Calif.

8. **Aporinellus laticeps** Banks, Journ. New York Ent. Soc. 19, 1911, pp. 230 and 231, ♀.
   Type-locality: Boulder, Colo.
9. **Aporinellus medianus** Banks, Bull. Mus. Comp. Zoöl. 61, 1917, p. 97, ♀.
   Type-locality: El Cajon, Calif.
   Also known from Los Angeles, Calif., and Mid. F. Kaweah R., Sequoia Nat. Pk., 1700 ft., Calif.
10. **Aporinellus rufus** Banks, Journ. New York Ent. Soc. 19, 1911, p. 230, ♀.
    Type-locality: Boulder, Colo.
11. **Aporinellus wheeleri** sp. nov., ♀.
    Type-locality: Stony Brook Reservation, Boston, Mass.

The following three Nearctic Psammocharids have been described under *Aporus;* since in my opinion they do not belong in *Aporinellus* Banks, their status may be briefly discussed.

Aporus magnus Banks, 1910,[1] is based on a ♂ from Fedor, Lee County, Texas. Mr. Banks has informed me that he has transferred this to *Pedinaspis*, and after examining the type specimen I fully agree with him. The pronotum is very long, as long as the mesonotum and distinctly flattened above; the posterior margin of the propodeum is deeply emarginate but the lateral angles are not spinose nor conical. There are three cubital cells in the fore wings, all broadly open on the radial vein. Length 12 mm.

Aporus minimus Cresson, 1872,[2] was based on a ♂ from Texas. I have not seen the type, but a ♂ taken by Mr. Banks at Falls Church, Va., agrees perfectly with Cresson's description. It is about 3 mm. long; the propodeum is very feebly emarginate behind, but there are no projecting lateral edges; the pronotum is convex. The venation of the fore wings is peculiar; the radial cell is long and narrow; there are two cubital cells, the second of which is scarcely half as long as the first, regularly trapezoidal, much narrowed on both sides on the radial vein; it receives the first recurrent vein near the first transverse cubital and the second recurrent about its middle. If this specimen represents the true *Aporus minimus* Cresson, the species will probably be placed in

[1] Journ. New York Ent. Soc. 18, p. 126.
[2] Trans. Amer. Ent. Soc. 4, p. 207.

the European genus *Aporus* Spinola; its exact position, however, cannot be decided upon till the female is discovered.

Aporus rufiventris Cresson, 1872,[1] is undoubtedly not an *Aporinellus* as can readily be seen from the description: it possesses three cubital cells in the fore wings and has the propodeum transversely wrinkled; the abdomen is entirely bright fulvo-ferruginous, sericeous. Mr. Banks, who once examined the type, informs me that it most probably belongs in *Pedinaspis.* It was described on a ♀ from Texas. Length about 7 mm.

Several of the Psammocharids described from Mexico undoubtedly belong to *Aporinellus* and in some instances may even be identical with some of the species known from the United States.

Pompilus tæniatus Kohl[2] from Orizaba, Mexico, certainly is an *Aporinellus.* There are two cubital cells and the author writes in the description: "Mittelsegment beiderseits zahnförmig ausgezogen und zeigt genau die Bildung wie bei *P. 6-maculatus.*" The size, color and arrangement of the sericeous pubescence are similar to those of *A. ferrugineipes* (Viereck) with which this species is perhaps identical.

Pompilus (*Aporus*) *yucatanensis* Cameron[3] of North Yucatan, Mexico, is said to have "the median segment rather long; the apex oblique, at the sides projecting into stout teeth-like processes. . . . The fore wings with only two cubital cellules." Undoubtedly an *Aporinellus* and perhaps not specifically different from *A. fasciatus.*

Pompilus (*Aporus*) *decorus* Cameron, *P. monticola* Cameron, *P. flavomarginatus* Cameron and *P.* (*Aporus*) *smithianus* Cameron,[4] all of Mexico, apparently are not true *Aporinellus* though possessing two cubital cells in the fore wings.

[1] Trans. Amer. Ent. Soc. 4, p. 207.
[2] Verh. zool.—bot. Ges. Wien 36, 1886, pp. 315 and 336.
[3] Biologia Centr. Amer. Hymenoptera 2, 1893, p. 189.
[4] *Op. cit.* pp. 190–191.

A SINGULAR NEOTROPICAL ANT (*PSEUDOMYRMA FILIFORMIS* FABRICIUS).[1]

By William Morton Wheeler.

In his "Systema Piezatorum," published in 1804, Fabricius described a remarkable neotropical ant as *Formica filiformis*, in the single sentence: "Formica elongata, filiformis, flava, abdominis basi nigricante, petioli binodi." In a second sentence, after the citation of the locality: "Habitat in America meridionale. Dom. Smidt, Mus. Dom. de Sehestedt," he reworded the description, with the addition of the adjective "parvum." The description undoubtedly refers to a deälated female specimen and not to a worker, as stated by Dalla Torre in his "Catalogus Hymenopterorum" (Vol. 7, 1893, p. 56).

In 1855 Frederick Smith described all three phases of the same ant from specimens taken by H. W. Bates at Villa Nova, Brazil, but named it *Pseudomyrma cephalica*. Smith was greatly interested in the ants of the genus *Pseudomyrma* and the ant under consideration seems to have been a particular favorite with him, for he published more figures of it than of any other species. What interested him most was undoubtedly the very aberrant character of the female, especially of its head, for in all other species of *Pseudomyrma* the female is very much like the worker. Though brief his description of all three phases of *filiformis* is clear, and his drawings though schematic enable one to recognize the species without difficulty.

Since the time of Frederick Smith myrmecological literature contains no unequivocal reference to the worker of Fabricius' species either under the name of *filiformis* or of *cephalica*. This is because Forel, in the Biologia Centrali-Americana (1899–1900), redescribed and figured the worker from Guatemala as *Ps. biconvexa* and continued to cite it under that name till 1912 when he published the latest reference I have seen of the insect. I am certain of the specific identity of *biconvexa* with *filiformis*, because during the winter of 1911–1912 I found two fine colonies in Guatemala, each containing, not only numerous females and males

[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 161.

agreeing with Fabricius' and Smith's descriptions of *filiformis* and *cephalica*, but also many workers agreeing perfectly with Forel's description and with a cotype of *biconvexa* which he kindly gave me many years ago.

The genus *Pseudomyrma*, owing to the great number and variability of its species is one of the most difficult of ant-genera. As a small contribution to the revision to which it must before long be submitted I give a fuller description of the worker, female and male of *Ps. filiformis*, with larger and more detailed and I trust also somewhat more accurate figures than those published by Smith.

Pseudomyrma filiformis (Fabr.).

Formica filiformis Fabricius, Syst. Piez. 1804, p. 405 ♀.

Leptalea filiformis Erichson, Arch. f. Naturg. 5, 1839, p. 309 ♀.

Pseudomyrma cephalica F. Smith, Trans. Ent. Soc. London (2) 3, 1855, p. 168, Pl. 13, Figs. 12–17, ☿ ♀ ♂; F. Smith, Cat. Hym. Brit. Mus. 6, 1858, p. 155, Pl. 10, Figs. 25, 26 ☿ ♀ ♂; Roger, Berlin, Ent. Zeitschr. 6, 1862, p. 289.

Pseudomyrma filiformis Mayr, Verhand. Zoöl. bot. Ges. Wien, 1863, p. 452 ♀; Roger, Berlin, Ent. Zeitschr. 1863, p. 24 ♀; Mayr, Sitzb. Akad. Wiss. Wien 61, 1870, p. 407 ♀; Dalla Torre, Cat. Hym. 7, 1893, p. 56; Forel, Sitzb. Bayr. Akad. Wiss. 1911, p. 278, ♀; Forel, Biol. Centr. Amer. Formicid. 1899–1900, p. 86 ♀.

Pseudomyrma biconvexa Forel, Biol. Centr. Amer. Formicid. 1899–1900, p. 95, Pl. 4, Fig. 10 ☿; Forel, Ann. Soc. Ent. Belg. 50, 1906, p. 229 ☿; Forel, Sitzb. Bayr. Akad. Wiss. 1911, p. 277 ☿; Forel, Mem. Soc. Ent. Belg. 20, 1912, p. 30 ☿.

Worker (Fig. 1). Length 4.5–5.8 mm.

Head about $1\frac{1}{2}$ times as long as broad, subelliptical, with straight posterior border and evenly convex sides, scarcely narrower in front than behind; eyes about half as long as the sides, in front of the middle, rather flat. Mandibles with convex external border, apical border with two large terminal and four small basal teeth, the basal border with three small separated teeth. Clypeus short, emarginate on each side, with a short, subrectangular median lobe. Frontal carinæ short, closely approximated; frontal groove absent. Antennæ short, scapes scarcely reaching the middle of the internal

orbits; first and last funicular joints longer than broad, the remainder scarcely as long as broad. Thorax slender; pronotum distinctly longer than broad, scarcely broader in front than behind, submarginate on the sides posteriorly, with rounded humeri, in profile evenly convex above. Mesonotum circular, rather prominent, sloping to the mesoëpinotal suture, which lies in a rather deep impression bearing the metathoracic spiracles. Epinotum as long as the pro- and mesonotum together, broader in front than behind, somewhat compressed laterally, the base much longer than the declivity, in profile moderately convex and passing with an even curve into the declivity. Petiole more than twice as long as broad, the short peduncle passing gradually into the low rounded node which is only about $\frac{1}{3}$ as high as the length of the segment, a little more abruptly constricted behind, the sides scarcely compressed, its ventral surface with a small tooth anteriorly. Postpetiole

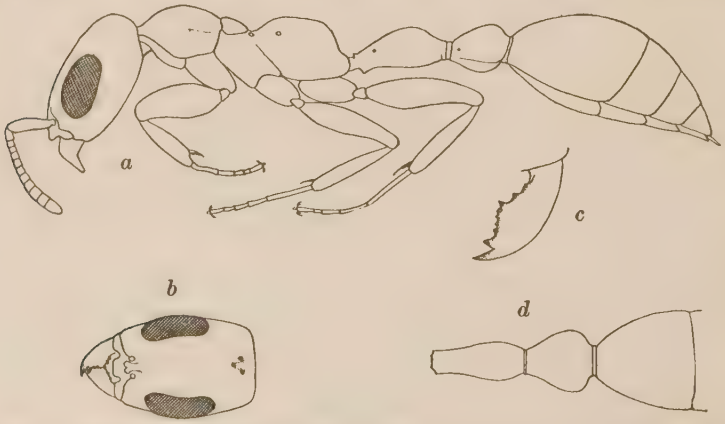


Fig. 1. *Pseudomyrma filiformis* Fabr. Worker. *a*, in profile; *b*, head from above; *c*, mandible; *d*, petiole, postpetiole and first gastric segment from above.

twice as broad as the petiole and about as broad as long, narrowed in front, subtriangular from above and laterally. Gaster rather long, first segment as long as broad. Legs moderately long, fore femora slightly swollen.

Subopaque or glossy; head more shining, especially above; mandibles striatopunctate; antennal scapes smooth and shining; body and legs very finely punctate, head and pronotum a little less densely than the remainder of the body.

Hairs and pubescence white, the hairs short and sparse, rather uniformly distributed on the body, absent on the legs; pubescence fine, dense and hiding the sculpture on the gaster, postpetiole, petiole, epinotum and legs, so that these parts appear pruinose, more dilute on the pronotum and especially on the head.

Head and pronotum yellowish red; mandibles, antennæ and clypeus lemon yellow; remainder of body fuscous; meso- and epinotum and petiole suffused with reddish; apical margin of first gastric segment and base and apex of succeeding segments, tarsi, trochanters, tips of coxæ, bases and tips of tibiæ and femora brownish yellow. Mandibular teeth and ocellar region blackish.

Female. (Fig. 2.) Length 6.5–7 mm.

Head nearly $2\frac{1}{2}$ times as long as broad, suboblong, with broadly excised posterior border and straight, parallel sides, the eyes flat, about $\frac{1}{4}$ as long as the head, their posterior orbits slightly behind its

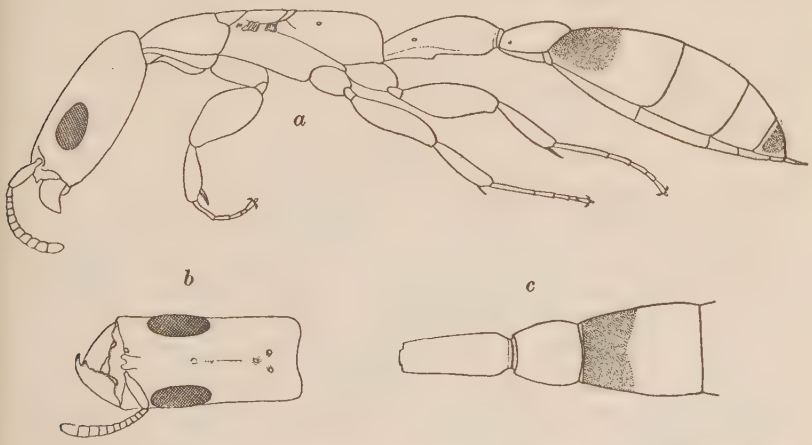


Fig. 2. *Pseudomyrma filiformis* Fabr. Female. *a*, lateral view; *b*, head and *c*, petiole, postpetiole and first gastric segment from above.

median transverse diameter. Ocelli small, only slightly larger than those of the worker. Mandibles and clypeus much as in the worker. Frontal carinæ very small and close together. Frontal groove represented by a shallow pit in the center of the head and a faint, impressed line running from it to the anterior ocellus. Antennæ shorter than in the worker, the scape scarcely reaching to the anterior orbit. Thorax very long and slender, nearly four times as long as broad, narrower than the head, the sides almost sub-

parallel, the pronotum and epinotum each forming about a third of the dorsal surface, the remaining third being formed by the mesonotum, scutellum and metanotum; the mesonotum very small, scarcely broader than long. In profile the thorax is flattened above, rounded in front and behind, the base of the epinotum long and straight and passing through a strong curve into the short, vertical declivity. Petiole from above nearly four times as long as broad, but little broader behind than in front, with nearly parallel sides; in profile feebly and evenly convex from before backwards, ventrally compressed and with an elongate blunt tooth near the middle. Postpetiole twice as broad as the petiole, somewhat longer than broad, subtrapezoidal, somewhat broader behind than in front, with convex rounded sides. Gaster long and slender, the first and second segments longer than broad, the first but little broader anteriorly than the postpetiole. Legs short, femora, especially the fore pair, flattened and dilated. Wings very short, scarcely 4 mm. long.

More shining throughout than the worker, the fine punctures being less dense, even on the thorax and gaster.

Hairs and pubescence much sparser than in the worker, the pubescence very dilute; only the base of the first gastric segment somewhat pruinose.

Brownish yellow; mesonotum, scutellum and epinotum sometimes a little darker; a broad spot at the base of the first gastric segment and nearly the whole dorsum of the fourth segment fuscous, or blackish; the middle and hind femora slightly infuscated; a minute spot in front of the insertion of the fore wing, one at each ocellus, and the teeth of mandibles black. Wings grayish hyaline, strongly iridescent, with pale brown veins and dark brown pterostigma.

Male. (Fig. 3.) Length 4.6–5 mm.

Head slightly longer than broad, subelliptical, with straight posterior border and behind the eyes with straight sides converging to the posterior corners. Eyes rather convex, about half as long as the head; ocelli large. Cheeks very short. Anterior clypeal border sinuately excised on each side, its middle produced as a distinct, bluntly pointed lobe. Mandibles convex, their apical borders finely and indistinctly denticulate. Frontal carinæ short, much more widely separated than in the worker and female.

Frontal groove distinct. Antennæ long, filiform, 12-jointed; scape short, about twice as long as broad, first funicular joint as broad as long, remaining joints cylindrical, the second distinctly longer than the third. Thorax elongate; mesonotum prominent, with distinct Mayrian furrows. Petiole and postpetiole shaped somewhat as in the worker but less convex dorsally, the former without a ventral tooth. Gaster long and narrow. Legs long and slender, the femora not dilated.

Finely punctate, but the punctures more distinct than in the female, so that the surface of the body is somewhat less smooth and shining; mandibles smooth, sparsely punctate.

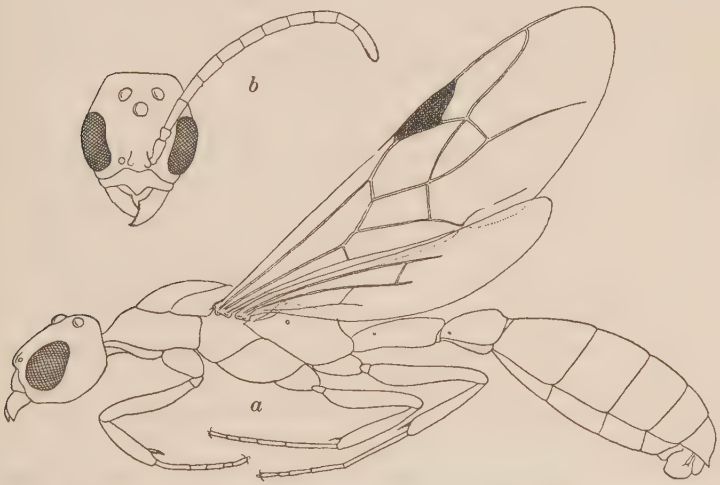


Fig. 3. *Pseudomyrma filiformis* Fabr. Male. *a*, lateral view; *b*, head of same, dorsal views.

Hairs whitish, short and very sparse; pubescence rather long and abundant, uniformly investing the body and appendages.

Brown; mandibles, clypeus, scape and first funicular joint, articulations and sutures of the body and legs dull ivory or brownish yellow. Wings a little darker than in the female.

Type-locality: "South America" (Smidt).

Brazil: Villa Nova (H. W. Bates).

Trinidad (Urich).

Colombia: Santa Marta (A. Forel).
Panama: (Stretch); Bugaba and Caldera (Champion).
Costa Rica (Tonduz).
Guatemala: (Stoll); Pantaleon (Champion); Zacapa and Patulul (Wheeler).

According to Frederick Smith "all the sexes of this species were found by Mr. H. W. Bates in their formicarium, the chambers of which were excavated in dead twigs." The colonies which I found at Zacapa and Patulul were nesting in dead branches lying on the ground in shady places. These branches, 5 to 7 feet long and 1 to $1\frac{1}{2}$ inches in diameter, together with their twigs, had been tunnelled throughout by the ants. The colonies were very populous, comprising hundreds of individuals and therefore larger than those of most species of *Pseudomyrma*. *Ps. filiformis* seems also to differ from many species of the genus (*sericea*, *triplaridis*, *arboris-santæ*, *belti*, *spinicola*, *flavidula*, etc.) in preferring to live in the cavities of dead instead of living plants. There can be little doubt that *filiformis* is a rare or sporadic species. Dr. W. M. Mann, who collected ants assiduously in Brazil in the region explored by Bates, failed to find it, and although I found numerous colonies of many species of *Pseudomyrma* in Central Ameria I saw only two of *filiformis*. It seems to me not improbable that the slender, smooth, aberrant female of this ant may start her colony as a temporary parasite on some other species of *Pseudomyrma*, presumably *Ps. flavidula*, which she so strangely resembles in color.

In his paper on the classification of the Myrmicinæ (Intorno alla classificazione dei Myrmicinæ, Rend. R. Accad. Sc. Bologna, 1914, p. 34) Emery states that the males of the tribe Pseudomyrmini have 13-jointed antennæ. This is certainly an error. All the numerous males I have examined of the various genera of the tribe, *Pseudomyrma*, *Tetraponera* (=*Sima* auct.), *Pachysima* and *Viticicola* gen. nov. (genotype *Sima tessmanni* Stitz of West Africa) have 12-jointed antennæ like the workers and females.

Forel has described the following variety, which I have not seen, as a variety of *Ps. biconvexa:*

Pseudomyrma filiformis var. **longiceps** Forel.

Ps. biconvexa var. *longiceps* Forel, Ann. Soc. Ent. Belg. 50, 1906, p. 229. ☿.

"*Worker.* A little larger than the typical form. The head especially is perceptibly longer, more than $1\frac{1}{2}$ times as long as broad, with subparallel sides. In other respects identical with the typical form."

Santa Marta, Colombia (A. Forel).

NOTES ON *EUSTROPHUS BICOLOR* FABR., BRED FROM FUNGI (COLEOPTERA).

By Harry B. Weiss,
New Brunswick, N. J.

This species, which according to Smith[1] occurs throughout New Jersey from September until the following June, was recently bred from larvæ found feeding in *Pleurotus sapidus*[2] at Monmouth Junction, N. J., on May 30 and in *Polyporus squamosus*[2] at Union, N. J., on May 20. The larvæ collected at Monmouth Junction became full grown during the first week of June and pupated, this stage requiring about one week. The infested fungi which were kept in glass beakers dried out considerably and the larvæ left them and pupated in the bottoms of the containers. It is, therefore, not known where pupation takes place under natural conditions. As the fungi were more or less destroyed by the larvæ, it seems likely that the quiescent stage is passed in the soil or under bark.

Pleurotus sapidus which belongs to the family *Agaricaceæ* is a common saprophytic form occurring on dead, deciduous wood and is one of the edible species closely resembling *Pleurotus ostreatus*, the oyster mushroom. *Polyporus squamosus* is a member of the family *Polyporaceæ* and occurs on living, deciduous trees according to Overholts[3] and on dead parts of living, deciduous trees according to Stevens.[4] Stevens also states that the mycellium causes a white rot of nut, ornamental and fruit trees particularly maple, pear, oak, elm, walnut, linden, ash, birch, chestnut and beech.

In the case of *Pleurotus sapidus*, the larvæ fed on the context and stipe, completely riddling them. In *Polyporus squamosus* both the context and tubes were eaten. Other species of fungi on which adults only were found are *Polyporus betulinus*, Princeton Junction, N. J., April 24; *Polyporus versicolor*, Riverton, N. J., May 5; and *Dædalia confragosa*, Kingston, N. J., May 8; all belonging to the *Polyporaceæ*. Up to the present, however, larvæ have been found only in the two species mentioned in the first part of these notes.

[1] Smith, J. B., Insects of New Jersey (N. J. State Mus. Rept. 1909).
[2] Identified by Mr. Erdman West.
[3] Overholts, L. O., Polyporaceæ of Mid. Wes. U. S. (Wash. Univ. Studies, III, I, 1, p. 17).
[4] Stevens, F. L., Fungi Which Cause Plant Disease (1913).

Eustrophus bicolor Fabr.

Full-grown Larva. Length 6 to 7 mm. Width 1.5 to 1.8 mm. Elongate, subcylindrical, sparsely hairy, whitish or sordid white except head which is dark and the dorsal surfaces of the thoracic and abdominal segments which bear dark brown to black subrectangular transverse areas giving the dorsal surface a banded appearance. Head large; antenna 4-segmented, each segment subcylindrical, basal segment widest, second segment shortest, third segment bearing the slender fourth segment and a minute spine. Maxillary palpus subcylindrical, 3-segmented, almost as long as antenna, first and second segments subequal in length, third segment one and one-half times length of first. Labial palpus subcylindrical, short, 3-jointed, joints equal in length. Abdominal segments one to eight slightly produced at sides. Ninth abdominal segment bears two dorsal, prominent, reddish-brown tubercles, each tipped with a chitinous hook slightly curved anteriorly. Bases of dorsal tubercles covered with minute, dark tubercles each bearing a hair. Legs well developed, sparsely hairy, anterior surfaces of femora well supplied with minute spines. Dorsal surface of head bears a subcircular, faintly impressed line. Faint, median, whitish line on dorsal surface of first and second thoracic segments sometimes continuing on abdominal segments. Spiracles on second thoracic and abdominal segments one to eight. Abdominal spiracles just below dorsal colorations.

Pupa. Length 5 to 6 mm. Width, 2 mm. Whitish, elongate-oval, rounded anteriorly, gradually tapering posteriorly. Head and thorax covered with minute tubercles, each bearing a long hair. Transverse patches of similar hair-bearing tubercles on dorsal surfaces of remaining segments. Ventral surface almost devoid of hairs.

Adult. This was described by Fabricius in 1798 (Ent. Syst. I, p. 497). Sharp[1] states that about 200 species of *Melandryidæ* are known, chiefly from temperate regions and that they frequent dry wood or fungi. He also says that the few described larvæ are varied in their details and cannot be generalized at present. Blatchley[2] writes that *E. bicolor* is common throughout Indiana, January 19 to September 20 and found beneath bark especially that of fungus covered logs.

[1] Sharp, D., The Cambridge Natural History, Insects, Part II, p. 265.
[2] Blatchley, W. S., Coleoptera of Indiana, 1910.

NOTES ON FOREST INSECTS.

II. NOTES ON SEVERAL SPECIES OF PITYOPHTHORUS BREEDING IN THE LIMBS AND TWIGS OF WHITE PINE.

By M. W. Blackman Ph. D.

Professor of Forest Entomology, New York State College of Forestry, Syracuse, N.Y.

Pityophthorus cariniceps LeConte.

Pityopththorus cariniceps LeConte is one of the largest species of the genus *Pityophthorus* occurring in the eastern section of the country. It is found from Nova Scotia to West Virginia and westward as far as Michigan. For many years it has been known that it breeds in spruce (Hopkins,[1] 1893, p. 208) and white pine (Chittenden,[2] 1899) but it is still classed by Blatchley & Leng[3] 1916 as "quite rare." In the vicinity of Syracuse this species could hardly be classed as rare, although it is not as common as are several other species of scolytids. There is one pine grove about one and one-half miles from the college where the adults or brood can be found at any time during the spring or early summer breeding in the inner bark and sapwood of small limbs and twigs which have been storm-broken and have fallen to the ground during the previous winter.

On April 24, 1915, adults of *P. cariniceps* were observed starting their burrows in small storm-broken limbs and twigs of white pine in a dense pure stand of trees from 10 inches to 2 feet in diameter. The insects were working in limbs from $\frac{1}{4}$ inch to 1 inch in diameter and in nearly all instances the burrows were started near the axil of a smaller branch where the somewhat rough, folded outer bark furnished foothold for the little workers. Invariably it was the male which started the burrow. In a number of observed cases, groups of two or three beetles were found at these new burrows, the males working with part of their bodies in the recently started entrance gallery, while the others, which were

[1] W. Va. Exper. Sta. Bull. 32.
[2] U. S. Div. of Forestry Bull. 22.
[3] Rhynchophora or Weevils of N. E. America, Indianapolis, 1916.

females, lingered near and apparently took no farther part in the operations than occasionally to approach the working male and stroke him with their fore-legs and antennæ.

Some of the more advanced burrows opened at this time contained only a single male in the still uncompleted nuptial chamber, while in others the nuptial chamber was completed and occupied by the male and from one to three females. Some of these were preserved as specimens, while others were removed from their burrows and placed in jars with fresh pine limbs, into which the males immediately began burrowing. One of the new burrows thus started was examined nine days later (May 3) and was found to have three radiating egg-galleries containing eggs in the niches along each side. Several eggs, removed and preserved, were found to contain larvæ, the mandibles of which showed brown through the semi-transparent egg membranes. The remaining eggs—doubtless several days younger—when examined on May 6 were still unhatched, but on May 9, larvæ about one day old were found. On June 4, numerous apparently full grown larvæ and several pupæ were found although several of the parent adults were still alive in their egg-galleries.

Adults of the new generation emerged the following month during the writer's absence from the laboratory, and were numerous in the jars on his return July 2. It is thus apparent that several generations may occur during a single season and it seems probable that two broods per year are the rule in central New York. However, this depends very largely on the temperature and moisture conditions surrounding the particular branch in which the brood occurs. If this lies in a cool, shady spot where the sun never penetrates, the life processes are slowed up to such an extent that only one generation, or one and a half generations per year occur. In September, 1916, several branches, obtained where such conditions prevailed, contained young adults which from the character of their feeding burrows had fed as adults since midsummer. In other parts of the same woods, similar branches lying in places where the sun reached them during part of the day, had been long deserted by their brood and the feeding burrows showed that the young adults had remained in them a comparatively short time. The writer is certain that this difference is not entirely explained by the lengthened egg, larval and pupal periods, but that we have

here to deal not only with the slowing up of the life processes of the insect in all of its stages, but also with a retarding influence which the relatively lower temperature and higher humidity seems to exert directly upon the young beetle, which prevents it from leaving its old host. These conditions simulate partially and in a milder way the climatic influences which in the fall prevent adults from emerging, although they are fully matured and will leave their old host in a few days if brought into the laboratory where they are under fairly warm and stable temperature conditions.

The brood burrows of *P. cariniceps* are constructed in small limbs and twigs from 5 mm. to 16 mm. in diameter. They form rather coarse engravings and are excavated nearly entirely from the sapwood (Plate VII, fig. 1). The direction of the egg-galleries depends upon the diameter of the limb in which the insect works. In the smaller twigs they are necessarily mainly longitudinal, while in the larger material the direction is more likely to be diagonal. The nuptial chamber is rather large and very irregular, often with several short feeding galleries leading from it—probably made by the male—in addition to the true egg-galleries. The egg-galleries in the material at hand, vary in number from one to five to the engraving, with an average of three. They are wide and deep and vary in length from $5\frac{1}{2}$ mm. to 65 mm. the average being about 24 mm. The egg-niches are irregularly arranged on each side of the gallery and are excavated nearly entirely from the wood, although the larvæ at first feed chiefly upon the bark. In the material studied the average number of niches in an egg-gallery is about 10, but varies from 1 to 37 in the individual galleries.

The insects found most commonly associated with *P. cariniceps* are *P. nudus* Sw., *P. granulatus* Sw., *P. puberulus* Lec., *Pitogenes hopkinsi* Sw., and an undetermined Thripid. Of these *P. puberulus* and *P. nudus* were associated only in the smaller twigs, while *Pityogenes hopkinsi* occurred only in those more than 1 cm. in diameter and here only rarely.

Pityophthorus canadensis Swaine.

Specimens of *Pityophthorus canadensis* Sw., which at the time were believed to be *P. cariniceps*, were taken by the writer on June 20, 1918, near Cranberry Lake in the Western Adirondack

region of New York. On later examination these proved to belong to the closely allied species recently described by Swaine (1917[1]). The adults were obtained from storm-broken small branches of white pine and had but recently entered the bark at the axils of smaller twigs, where they were constructing their brood chambers. Usually one male and two or more females were obtained from each nuptial chamber. In a few cases the females had started egg-galleries and had deposited several eggs but most of the burrows were not so far advanced. As these beetles were believed to be *P. cariniceps* no observations on the latter stages of the brood burrows were made, but so far as observed, the breeding habits seem to agree very closely with the older species.

Pityophthorus granulatus Swaine.

The distribution of *Pityophthorus granulatus* Swaine is given by Swaine[2] as Manitoba, Quebec, and Nova Scotia, and the host trees as Jack Pine, White Pine and Balsam Fir. Specimens of this species in central New York breed very commonly in the thin barked region of white pine. They are most frequently found in the shaded-out limbs of larger pine trees and in the upper regions of small trees killed or dying by suppression. Small suppressed pines in the "red topped" condition are nearly sure to contain the brood of these small beetles and while they are occasionally found in broken limbs and in slash, they are much more characteristic of slowly dying limbs and tops. They breed by preference in thin-barked pine from 1 inch to 3 inches in diameter but are also found rather frequently in smaller limbs and twigs down to $\frac{1}{4}$ of an inch thick, in which material they are likely to be accompanied by *P. nudus* Sw.

The brood burrows of *P. granulatus* (Plate VIII, fig. 2, 3) differ considerably from those of *P. cariniceps* in several respects. They are, of course, much finer as would be expected from the smaller, more slender form of the beetles making them, but the most striking differences have to do with the larger number of egg-galleries in each engraving and the extraordinary length of these egg-galleries.

The nuptial chamber is often very small—so small that in many cases it seems to be merely the meeting point of a number of egg-

[1] Dom. Can., Ent. Br., Dept. Agr., Bull. 14, p. 24, 25.
[2] Dom. Can., Ent. Br., Dept. Agri., Bull. 14, p. 106.

galleries. It varies from 2 mm. to 4 mm. in diameter and is usually by no means large enough to accommodate all of the inhabitants of the burrow at one time. Radiating from this nuptial chamber are from three to nine egg-galleries, each made by a different female. These lie nearly entirely in the sapwood grooving this deeply and scoring the inner bark only slightly. Where the egg-galleries are numerous they start from the nuptial chamber in all directions, often being nearly symmetrical in their arrangement near their origin (Plate VIII, fig. 2), when the engravings are in the larger limbs or tops. However, those galleries which start transversely or diagonally to the grain of the wood, soon curve and are continued in a general longitudinal direction.

As has been stated, the egg-galleries vary in number from three to nine and in the material studied there was an average of nearly six (5.7) to the engraving. With such a great preponderance of females it might be expected that they would show a decrease in fecundity as compared with other bark beetles. Yet such is not entirely true for in 58 egg-galleries studied, the average number of egg-niches is 28, as compared with 19.05 in *Ips. longidens*[1] Sw., 19.89 in *Pityogenes hopkinsi*[2] Sw., 20.84 in *Polygraphus rufipennis*[3] Kirby and 30.65 in *Eccoptogaster picea*[4] Sw. But the most extraordinary characteristic of the engravings of these little beetles is the length of the egg-galleries. A study of a number of engravings shows that these galleries made by the females vary in length from 6 mm. to 250 mm. (10 inches), with an average of 89.6 mm. for sixty-two egg-galleries. When the small size (1.6 mm. long) of the beetles is taken into consideration, it is seen that the female whose egg-gallery is 10 inches long (Plate VIII, fig. 3) had actually mined through the sapwood for a distance equal to 156 times her own length. The extraordinary length of these galleries is also brought out by comparing their average length of 89.6 mm. with those of *P. hopkinsi*[5] (23.1 mm.), *P. rufipennis*[5] (24.55 mm.), *E. picea*[5] (27.36 mm.) and *L. longidens*[5] (18.8 mm.).

The egg-galleries of *P. granulatus* differ from those of most scolytids also in that they are not kept free of frass, but with the

[1] Blackman, 1919, Psyche, Vol. 26, p. 88
[2] Blackman, 1915, N. Y. S. Coll. Forestry, Tech. Pub. No. 2, p. 50.
[3] Blackman and Stage, 1918, N. Y. S. Coll. Forestry, Tech. Pub. No. 10, p. 45.
[4] *Op. cit.*, p. 53.
[5] *Loc. cit.*

exception of the first few millimeters, are packed full of the detritus derived from the excavation of the burrow. This doubtless is correlated with their unusual length. The egg-niches are spaced at considerably wider intervals than is common with other scolytids, seldom being closer together than 4 mm. and often being considerably farther apart. This is especially noticeable in the terminal portions of the longer burrows. It would seem that the female beetle continues to extend her burrows at about the same rate even after her egg laying is nearly or quite completed.

While absolute proof is not at hand, the evidence indicates that in the latitude of central New York there is but one generation of *P. granulatus* each year. It is doubtful if this insect is ever injurious. Usually, indeed, it should in my opinion be classed as beneficial from the standpoint of forestry, for by preference it attacks trees or limbs which are dying from suppression. In attacking dying suppressed trees, it hastens but little the death of trees which would inevitably soon be lost in any event. On the other hand, in attacking suppressed limbs, it completes the death of these and thus confers a benefit by hastening the natural pruning necessary for the production of good, clear timber.

Insects found associated with *P. granulatus* in white pine include *Chrysobothris femorata* Fabr., *C. dentipes* Germ., *Pogonocherus mixtus* Hald., *Leptostylus sexguttatus* Say., *Pityogenes hopkinsi* Sw., *Pityophthorus nudus* Sw., *P. cariniceps* Lec., *P. puberulus* Lec., and the predators, *Phyllobænus dislocatus* Say and *Hypophlœus tenuis* Lec. Cocoons of a small hymenopterous parasite have been found at the ends of the larval burrows but the writer has not succeeded in breeding these out.

Pityophthorus nudus Swaine.

Pityophthorus nudus Sw. is found in Quebec, Ontario and New York, and breeds in white spruce, *Picea canadensis* (Swaine, 1917, p. 30). It is very similar to *P. granulatus* not only in structure but also in habits. The writer has observed it in central New York breeding in small limbs of white pine where it is usually associated with *granulatus*, although it is here by no means as common as the latter. All our specimens of this species were obtained from limbs less than one-half inch in diameter, although it may occur in larger limbs and tops as well. The engravings made by the insects in

breeding are very similar to those of *P. granulatus*, the chief difference being in the shorter egg-galleries apparently characteristic of *P. nudus*.

Insects derived from the same material and associated with *P. nudus* include *P. granulatus* Sw., *P. cariniceps* Lec., *P. puberulus* Lec., *Pityogenes hopkinsi* Sw. and the clerid *Phyllobœnus dislocatus* Say.

Pityophthorus puberulus LeConte.

Pityophthorus puberulus Lec. is apparently distributed over the eastern portions of the United States and Canada and according to Swaine 1918 (*loc. cit.*) breeds in pine and balsam fir. The writer has found it in central New York only a few times but whenever found it always seemed to occur in immense numbers. The beetles attack the terminal twigs and smallest limbs of diseased or dying white pine branches. Occasionally it also attacks healthy terminal twigs as well, but seems to prefer most of all the twigs of branches freshly broken from the trees.

The adults bore through the bark of the smallest twigs at the bases of the pine needles and eat not only the inner bark but also a considerable part of the wood (Plate IX, fig. 4, b, c, d, e, f). They often penetrate into the center of the twig and sometimes continue their feeding burrow in the pith for some distance. These burrows in the smallest terminal twigs are primarily feeding burrows, although not entirely so.

One peculiarity in the feeding of *P. puberulus* is their apparent fondness for pitch. As a rule scolytids, even species which have demonstrated their ability to live in burrows flooded with pitch, and to dispose of this by the construction of pitch-tubes, avoid pitch-pockets and pitch-sinuses when possible. *P. puberulus*, however, shows no such avoidance of the numerous pitch sinuses, which extend longitudinally in the inner part of the more or less abnormal bark of diseased or broken limbs. On the contrary, when the burrowing beetle taps one of these sinuses, it seems nearly invariably to continue its mine along the course of the cavity. This species seems to have solved the question of manipulating the pitch not by removing it from its burrow and building it up around the entrance in the form of a pitch-tube, but to a great extent at least by eating it. When a pitch-sinus is tapped and the pitch begins to flow into the

insect's burrow, the beetle prevents the burrow from being flooded by partially plugging the opening into the pitch-sinus with bits of sawdustlike frass. The pitch-soaked frass is apparently used as food and that eaten is replaced with new bits of "saw-dust." This is continued until most of the more liquid pitch is drained from the sinus and then the sawdust plug is eaten away and the burrow continued along the pitch cavity. The foregoing is based on direct observation made with a binocular miscroscope.

The beetles breed not only in the terminal twigs (Plate IX, fig. 4, b, c, d, e, f), but also in the larger twigs from 4 mm. to 8 mm. in diameter (Plate IX, fig. 4, a). They nearly invariably enter at the axil of a smaller twig, constructing the nuptial chamber either on the surface of the wood or in the inner bark, depending upon the thickness of the latter. In the material at hand the egg-galleries are short and irregular both in diameter and in direction. In many cases the eggs are laid in piles or groups, and lie unprotected in one corner of the nuptial chamber or in a wide alcove extending from it. In still other instances the egg tunnels extend through the axis of the twig in the pith and the larvæ arising from the egg niches in the walls of the tunnel bore directly through the soft sapwood to the inner bark surrounding it, where they continue their burrows. The larval mines are broad and irregular and often coalesce so that it is not unusual, on removing the outer bark of larger twigs, to find a number of larvæ working in a common chamber excavated by their joint efforts. However, before pupating, each larva in such instances, constructs a short individual burrow ending in a pupation chamber. The larvæ also seem to eat pitch, as their burrows often involve pitch-sinuses and, indeed, individual burrows frequently follow one of the pitch-sinuses for some distance.

As regards the economic importance of *P. puberulus*, it will be seen at once that insects which possess to such a marked degree the ability to live in pitch, have the power to do considerable damage. However, according to the writer's observations, these minute beetles only occasionally attack perfectly healthy twigs. They seem much to prefer the twigs of freshly broken limbs, or of limbs which are undergoing suppression by shading, or which are unhealthy from other causes. Apparently, then, they are only occasionally injurious, and from the point of view of the forester, are perhaps as often beneficial in hastening natural pruning, and

thus aiding in the production of clear timber. The rôle they play in hastening the reduction of broken twigs and limbs to humus is also mildly beneficial.

Pityophthorus cariniceps Lec. and *Pityogenes hopkinsi* Sw. are often associated with *Pityophthorus puberulus* in storm-broken limbs of white pine, while *Pityophthorus granulatus* Sw. and *P. nudus* Sw. frequently occur in the same suppressed pine limbs, and the work of all three combine in aiding in the death of such parts and thus hastening natural pruning. Other insects occurring in the larger portions of suppressed limbs, include *Chrysobothris dentipes* Germ., *C. femorata* Fabr., *Pogonocherus mixtis* Hald., and *Leptostylus sexguttatus* Say.

Explanation of Plates.

Plate VII.

Fig. 1. Brood burrows of *Pityophthorus cariniceps* in small storm-broken limbs of white pine. Note the coarse egg-galleries grooving the sapwood deeply and containing relatively few egg-niches. About four-fifths natural size.

Plate VIII.

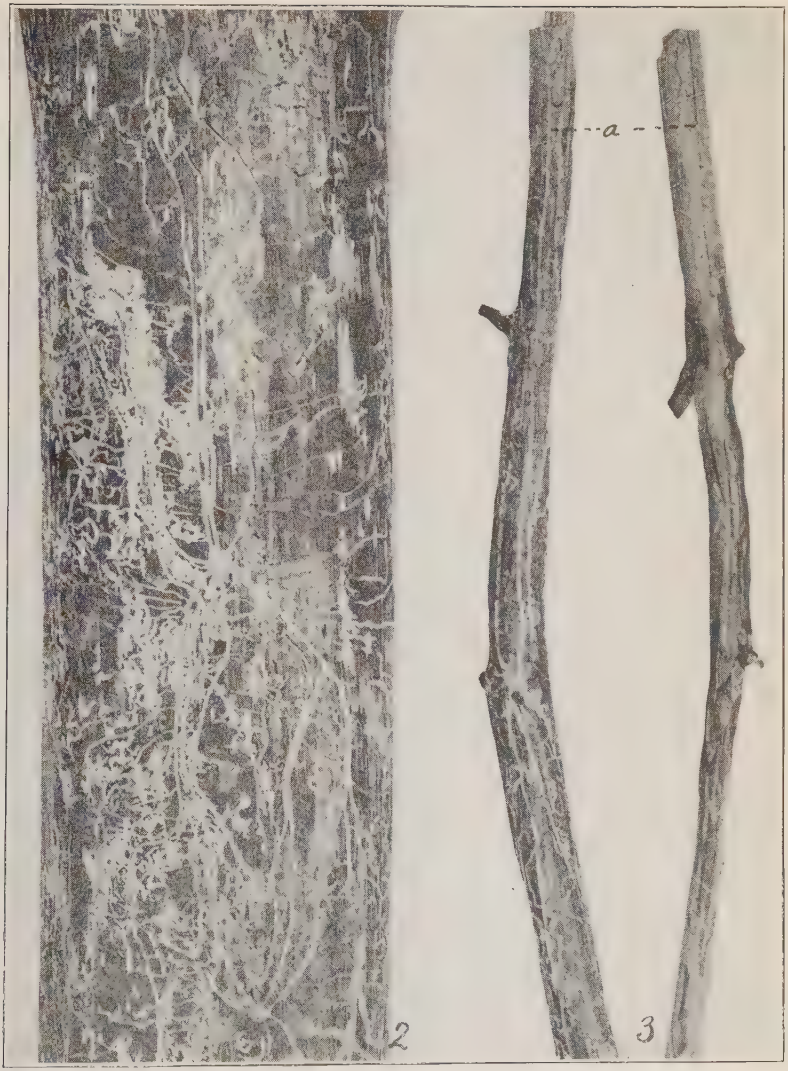
Fig. 2. Section of upper trunk of a small suppressed white pine showing the characteristic engravings made by *Pityophthorus granulatus*. Note the long fine egg-galleries with rather sparsely placed egg-niches from which the larval mines originate. The brood burrow originating in the center has 7 egg-galleries while that near the bottom has 9. About five-sixths natural size.

Fig. 3. Two adjacent pieces of a smaller limb showing brood burrow of *P. granulatus* having 6 egg-galleries. One of these marked "a" reaches a length of 250 mm. (10 inches). About four-fifths natural size.

Plate IX.

Fig. 4. Brood burrows and feeding burrows of *Pityophthorus puberulus*. "A" brood burrows in small limb 6 mm. in diameter; b, c, d, e, and f burrows in the smallest leaf bearing twigs of white pine. All magnified about $2\frac{1}{2}$ diameters.

Blackman—Forest Insects.



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Blackman.—Forest Insects.

THE OCCURRENCE OF *ANOPHELES PUNCTIPENNIS* IN NORTHERN NEW ENGLAND.

By Charles T. Brues,
Bussey Institution, Harvard University.

On a visit to northern Maine during the past summer, I had the opportunity to collect the larvæ of several species of mosquitoes, including *Anopheles punctipennis*, which has, so far as I can ascertain, not previously been reported so far north as this district.

In eastern Massachusetts where I have examined many localities, *A. punctipennis* is the most abundant and widespread Anopheles, and it is listed from many localities in New England by Howard, Dyar and Knab.[1] These include several in southern New Hampshire and one in Maine, while it has been found over the Canadian border at Ottawa. The present specimens are from Telos Lake which lies well toward the northern part of Maine in the region of spruce and fir forests. It is a day's journey from the nearest railway on the east and a two days' trip from the railway to the south, so that there is no possibility of mosquitoes reaching the lake during the summer to become established temporarily, and any occurring there can be considered as permanent members of the fauna. I think there can be no reasonable doubt that the larvæ are actually those of *A. punctipennis*. Although not to be distinguished anatomically from *A. quadrimaculatus*, the habitat of the two species is rather constantly quite different.

Compared with Ottawa and Weld the position of Telos Lake is as follows:

Weld, Maine,	Lat. 44° 12′ North.
Ottawa, Canada,	Lat. 45° 25′ North.
Telos Lake, Maine,	Lat. 46° 7′ North.

In Europe the extreme northern limit of malaria, and probably that of Anopheles also, lies at from 63° to 69° latitude while in North America malaria is said to be endemic at scattered localities as far north as the forty-fifth parallel. This would mean, of course, the presence of *Anopheles quadrimaculatus*, the northern range of which would thus appear to be nearly coincident with that of *A. punctipennis* in New England at least.

At Telos Lake, I secured also larvæ of *Culiseta impatiens* Walker and *Culex restuans* Theobald, both species of general occurrence in this region.

[1] Mosquitoes of North America, Vol. IV, pp. 1013 (1917).

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